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(54) A baking oven, particularly for bread or confectionery

(57) The present invention relates to a baking oven, particularly for bread or confectionery. It consists substantially of a closed compartment (1) within which a plurality of cooking surfaces (4) are envisaged, fixed or mobile, heated, and between which a hot air flow (6) may circulate. These cooking surfaces (4) are heated by first heating means (14), whilst the hot air flow (6) above the cooking surfaces (4) is heated by second heating means (15), independent of the first heating means (14). First measuring and adjustment means (19) are also envisaged for the temperature of the cooking surfaces (4), and second measuring and adjustment means (20) for the temperature of the air flow (6).

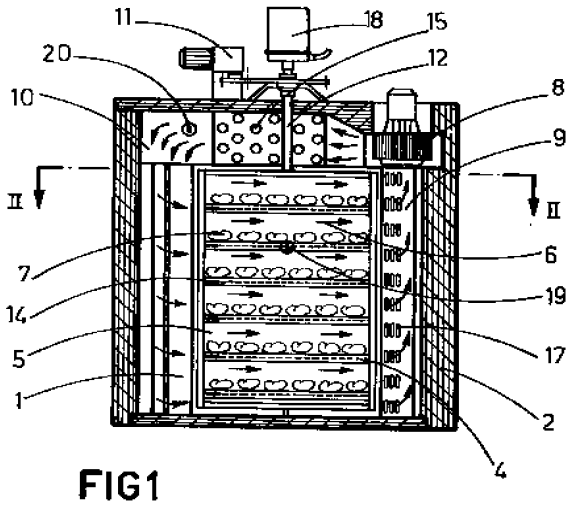

FIG1

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Description

The present invention relates to a baking oven, particularly for bread or confectionery.

Such a baking oven is ideal for use both in bakeries which produce bread or confectionery (either on a small-scale or at industrial level) and in canteens and restaurants, where the use of frozen bread or confectionery which require on-site baking is becoming increasingly frequent.

As is known, in the type of oven described, the heat source may be a burner or electric heating elements, and the ovens may be separated into two categories: having fixed or rotary cooking surfaces.

In the latter type of oven, according to the prior art, heat is transferred into the oven and yielded to the product exclusively by means of hot air convection.

As a result, rotary ovens of the known type are unsuitable for baking delicate products, which may be damaged by the hot air flow, nor are they suitable for baking bread or those products which require a strong supply of heat at the base, that is to say, at the area in which they rest against the cooking surfaces.

As regards ovens with fixed cooking surfaces, these may use as a heat source either the forced circulation of hot air, or heat exchangers (e.g.: of the fire tube type), or electric heating elements.

In accordance with the prior art, ovens with fixed cooking surfaces, which use both cooking surface heating and forced air circulation, may substantially be divided into three types.

The first type has heated cooking surfaces which separate various independent chambers, each chamber having an air flow, which does not supply heat, produced by a fan. Each independent chamber has its own access door.

This first type of oven with fixed cooking surfaces has, as is known, several disadvantages: since the chambers are independent, the number of cooking surfaces is limited; operating costs are relatively high because each chamber requires its own heating unit, and construction costs are equally high given the number of compartments and doors necessary; moreover, the overall dimensions of the oven are quite considerable.

A second type of oven has heated cooking surfaces positioned in a single chamber, with access door, an air flow which does not supply heat, produced by a fan envisaged within the chamber. A trolley with a number of shelves corresponding to the number of fixed cooking surfaces is also envisaged. The product is loaded onto the trolley, which is then placed in the oven's baking chambers, where the trolley shelves lie above the fixed cooking surfaces.

This second type of oven allows the economic disadvantage of the first type of oven mentioned to be resolved at least in part, although its own disadvantage lies in the fact that the heat yield from fixed cooking surface to product is not optimum due to the presence of the trolley shelf between them.

A third type of oven has a set of fixed cooking surfaces which are not heated. In this type of oven the product is heated by a forced convection hot air flow. The oven has a single door (which allows the insertion of a trolley ready-loaded with the product to be baked) which is, in turn, divided into a series of smaller doors, equivalent in number to the cooking surfaces.

This type of oven has the following main disadvantages: the absence of heated cooking surfaces does not permit the baking of those products which require a strong source of heat at the base, and the heat derived exclusively from the forced convection hot air flow does not allow the baking of delicate products, which may be damaged by the air.

The three types of oven mentioned above have not only the disadvantages described, but also significant functional disadvantages and limitations common to all three.

Firstly, such types of known ovens each have a single heat source (e.g.: a burner or electric heating elements, as in the first two cases described, or the forced convection of hot air, as in the third case), with a single temperature control system. With regard to this, it should be noticed that many types of product require a clearly defined ratio between the temperature of the cooking surface and the temperature of the air above (indicated here by the letter "R"). Variation of the said ratio R is impossible in the three types of oven described above, representing a significant functional limitation.

At present, the ratio R may be varied only in electric ovens with independent chambers, in which the temperature of the cooking surface and the temperature of the air at the top of the chambers can be regulated from the outside.

However, even electric ovens have several disadvantages which limit their use: they require a substantial current; operating and construction costs are high; variations in temperature are slow (therefore, these ovens cannot be used for products which require relatively sudden temperature variations during baking).

It may, therefore, be said that in all conventional ovens, with either fixed or rotary cooking surfaces, rapid variations in the baking temperature (useful for certain products) are impossible, as regards both the cooking surfaces and the air, if the oven is to be kept in optimum condition for the subsequent baking of other products. In reality, the temperature could be varied by adjusting the oven's heat source. However, this would necessitate an excessive amount of time to return the temperature to the operating level. Moreover, the duration of a cycle envisaging temperature variations would be very long using the known types of oven.

The aim of the present invention is, therefore, to overcome the afore-mentioned disadvantages and limitations, related to the prior art, by providing a baking oven able to bake products which require stronger heating at the base and/or heating by means of hot air forced con-

vection, and/or which require, in the meantime, variation of the ratio R between the temperature of the cooking surface and the temperature of the hot air above, during the baking cycle, or even variations in the overall temperature during the cycle.

This aim, as well as others, is attained by the present invention, a baking oven whose main features are described in the claims.

On the basis of the said features, the oven disclosed by the present invention allows:

- products to be baked using heated or unheated cooking surfaces, depending on requirements;
- products to be baked with or without a hot air flow, depending on requirements;
- baking cycles to be completed in various stages;
- variations in the ratio between the temperature of the cooking surface and the temperature of the hot air flow above, depending on requirements;
- rapid variations in the temperature of the hot air, in accordance with operating requirements.

The present invention will now be described in detail, by way of example, with the aid of the accompanying drawings, which illustrate two preferred embodiments (respectively a baking oven with fixed cooking surfaces and a rotary oven), in which:

- figure 1 is a schematic vertical cross-section of the rotary oven disclosed by the present invention;
- figure 2 is a schematic cross-section of the oven shown in figure 1, along the line II-II in figure 1;
- figure 3 is a plan view of the oven illustrated in figure 1;
- figures 4 and 5 are schematic cross-sections, along the lines IV-IV and V-V shown in figure 3, which highlight two characteristic positions of the device which reduces the temperature of the air in the oven;
- figure 6 is a schematic vertical cross-section of the oven with fixed cooking surfaces disclosed by the present invention;
- figure 7 is a schematic cross-section of the oven illustrated in figure 6, along the line VII-VII in figure 6;
- figures 8 and 9 are schematic cross-sections, similar to figure 6, highlighting two characteristic positions of the device which reduces the temperature of the air in the oven.

With reference to the accompanying drawings, the oven disclosed by the present invention, in both embodiments illustrated (with rotary cooking surfaces in figures 1 to 5, and with fixed cooking surfaces in figures 6 to 9) consists substantially of a closed compartment 1, delimited by insulated perimeter walls 2 and fitted with an access door 3. It should be noticed that in the embodiment shown in figure 2, relative to the oven with rotary cooking surfaces, two opposite doors 3 are illustrated, designed to facilitate the insertion of products in the oven on one side, and their removal from the other side.

In general terms, within the compartment 1, a series of cooking surfaces 4 is envisaged, one on top of the other, which in turn create sub-compartments 5 each one delimited, below by one of the cooking surfaces 4, and above by the forced convection air flow 6 present above the cooking surface 4 and in contact with the products to be baked 7 thus positioned.

The air flow 6 is produced by a fan unit 8 connected to an intake duct 9 and a delivery duct 10 connected to the compartment 1 and, in any case, to all of the sub-compartments 5.

The arrows in figures 1 and 2 (relative to the oven with rotary cooking surfaces 4) and in figure 7 (relative to the oven with fixed cooking surfaces 4) clearly indicate the circulation of the air flow 6.

Moreover, with specific reference to figures 1 and 3, the numeral 11 is used to indicate a variable speed motor which drives a vertical shaft 12, causing the trolley bearing the cooking surfaces 4 to rotate.

For both types of oven, with fixed or rotary cooking surfaces, two distinct and independent heating means are envisaged: the first, indicated by the numeral 14, designed to heat the cooking surfaces 4, and the second, indicated by the numeral 15, heating the air flow 6.

In the embodiments illustrated in the accompanying drawings, the first heating means 14 consist of electric heating elements (although any suitable means could be used) housed within the cooking surfaces 4, whilst the second heating means 15 consist of tubular heat exchangers (again, any suitable means could be used) located in the intake duct 9, or delivery duct 10, of the fan unit 8 and being close to the latter (see figures 1 and 7).

With reference to figures 1 to 5 (oven with rotary cooking surfaces) the numeral 16 indicates vertical openings in the delivery duct 10, through which the air flow 6 passes into the sub-compartments 5, and from these to the intake duct 9 through the slots 17.

The numeral 18 indicates a connector for supplying power to the cooking surfaces 4. The numerals 19 and 20 indicate, respectively, a first probe (connected to the connector 18) positioned inside a cooking surface 4, and a second probe, positioned inside the delivery duct 10 for the hot air flow 6.

The first probe 19 measures the temperature of the cooking surfaces 4 and adjusts it, the probe being connected to a control panel (not illustrated) which adjusts the power supplied to the electric heating elements 14.

The second probe 20 measures the temperature of the air flow 6 and adjusts it, this probe being connected to a control panel which adjusts the heat generator connected to the heat exchangers 15.

The said second probe 20 also controls a (rapid) cooling device for the air flow 6 in accordance with the deviation measured (by the probe itself) between the temperature of the air flow 6 in the sub-compartments 5 and a temperature set on the oven's control panel (not illustrated) depending on the operating requirements of the baking cycle envisaged.

More precisely, the afore-mentioned (rapid) cooling device may, in accordance with the embodiments illustrated in figures 4 and 5 (oven with rotary cooking surfaces) and 8 and 9 (oven with fixed cooking surfaces), consist of a mobile gate valve 21 which can allow the forced convection air flow 6 to communicate with the outside of the oven.

For this purpose, an aspirator 22 is envisaged, connected to a delivery tube 23 (24) with an outlet to the outside of the oven, and a suction tube 25 (26) connected to the oven compartment 1.

The gate valve 21 is positioned inside the suction tube 25 (26) near to the aspirator 22 and moves between a closed position (see figures 5 and 8) and an open position (see figures 4 and 9) in which the oven compartment 1 communicates with the aspirator 22.

Claims

1) A baking oven, particularly for bread or confectionery, consisting substantially of a closed compartment (1), delimited by insulated perimeter walls (2) and fitted with at least one access door (3), said compartment (1) being envisaged with a plurality of cooking surfaces (4), which in turn create sub-compartments (5), each one delimited, below by one of the said cooking surfaces (4), and above by the forced convection air flow (6) present above the said cooking surface (4); a fan unit (8) being envisaged, connected to an intake duct (9) and a delivery duct (10), both connected to the said compartment (1), characterized in that the said cooking surfaces (4) are fitted with first heating means (14) and the air flow (6) present above the cooking surfaces (4) is heated by second heating means (15), independent of the first means (14); first temperature measuring and adjustment means (19) for the cooking surfaces (4) being connected to the said cooking surfaces (4), there being second means (20) for measuring and adjusting the temperature of the said air flow (6).

2) The baking oven as described in claim 1, characterized in that the said first heating means (14) consist of heat sources in the cooking surfaces (4).

3) The baking oven as described in claim 1, characterized in that the second heating means (15) consist of heat sources positioned inside the delivery duct (10) of the said fan unit (8).

4) The baking oven as described in claim 1, characterized in that the said first temperature measuring and adjustment means for the cooking surfaces (4) consist of at least a first probe (19) positioned in a corresponding cooking surface (4), the said first probe (19) being connected to the first heating means (14).

5) The baking oven as described in claim 1, characterized in that the said second temperature measuring and adjustment means for the air flow consist of at least a second probe (20) positioned inside the said delivery duct (10), the said second probe (20) being connected to the second heating means (15).

6) The baking oven as described in claim 1, characterized in that a device is envisaged for cooling the said forced convection air flow (6), said device being controlled by the second temperature measuring and adjustment means (20) for the air flow (6) in relation to the deviation measured between the temperature of the air flow (6) in the sub-compartments (5) and a set value for the said air flow (6).

7) The baking oven as described in claim 6, characterized in that the said air cooling device consists of a mobile gate valve (21) which allows the forced convection air flow (6) to reach the outside of the oven.

8) The baking oven as described in claim 7, characterized in that at least one aspirator (22) is envisaged, connected to a delivery tube (23-24) with an outlet to the outside of the oven and a suction tube (25-26) in communication with the said forced convection air flow (6), said gate valve (21) being positioned inside the suction tube (25-26) and moving between a closed position and an open position corresponding to the communication of the said forced convection air flow (6) with the aspirator (22).

9) The baking oven as described in claim 1 or subsequent claims, characterized in that the said cooking surfaces (4) are fixed.

10) The baking oven as described in claim 1 or subsequent claims, characterized in that the said cooking surfaces (4) are mobile.

11) The baking oven as described in claim 10, characterized in that the said cooking surfaces (4) rotate about a vertical axis (12), a drive unit (11) being envisaged to rotate the said cooking surfaces (4).

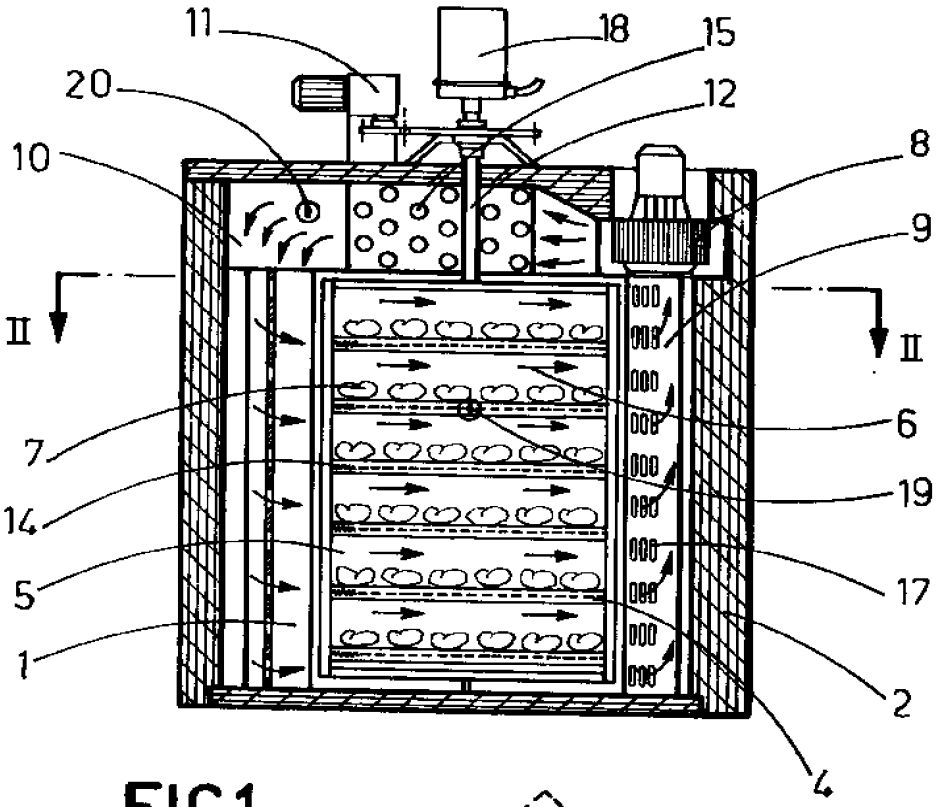


FIG1

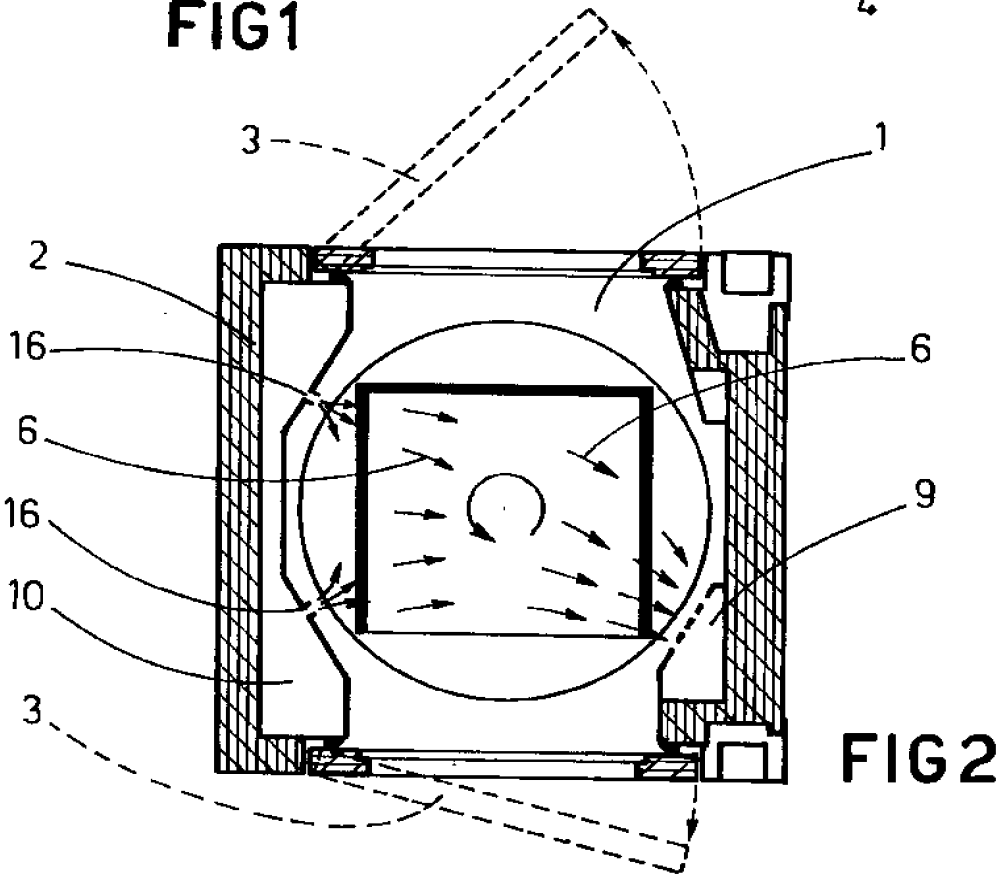


FIG2

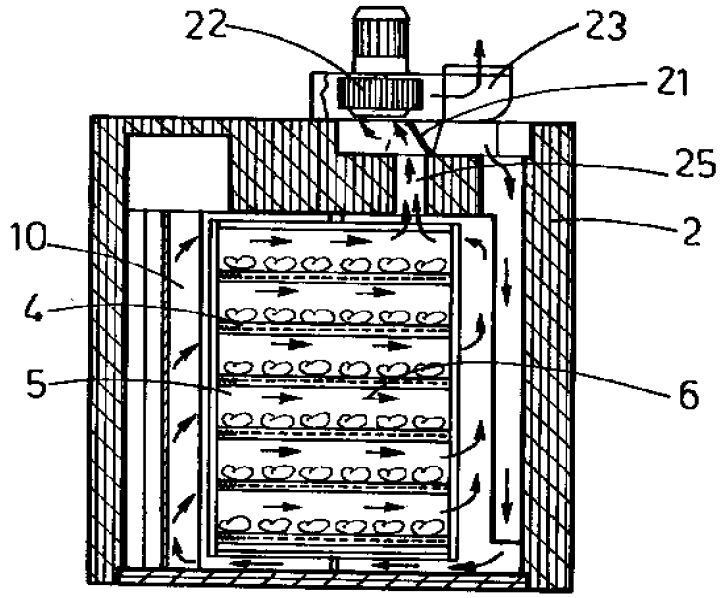


FIG4

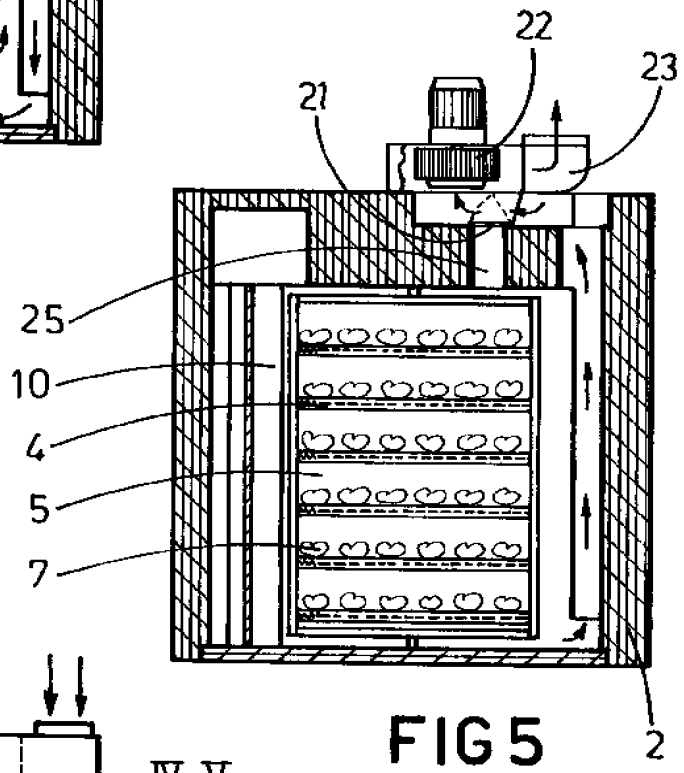


FIG5

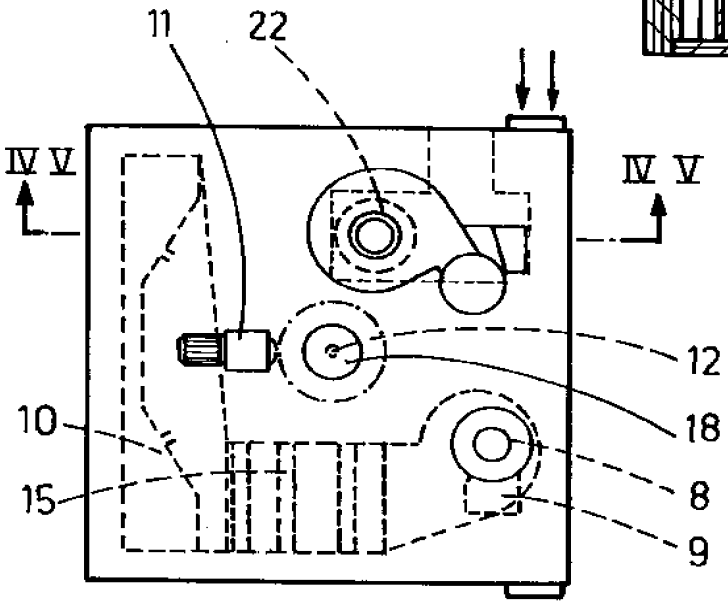
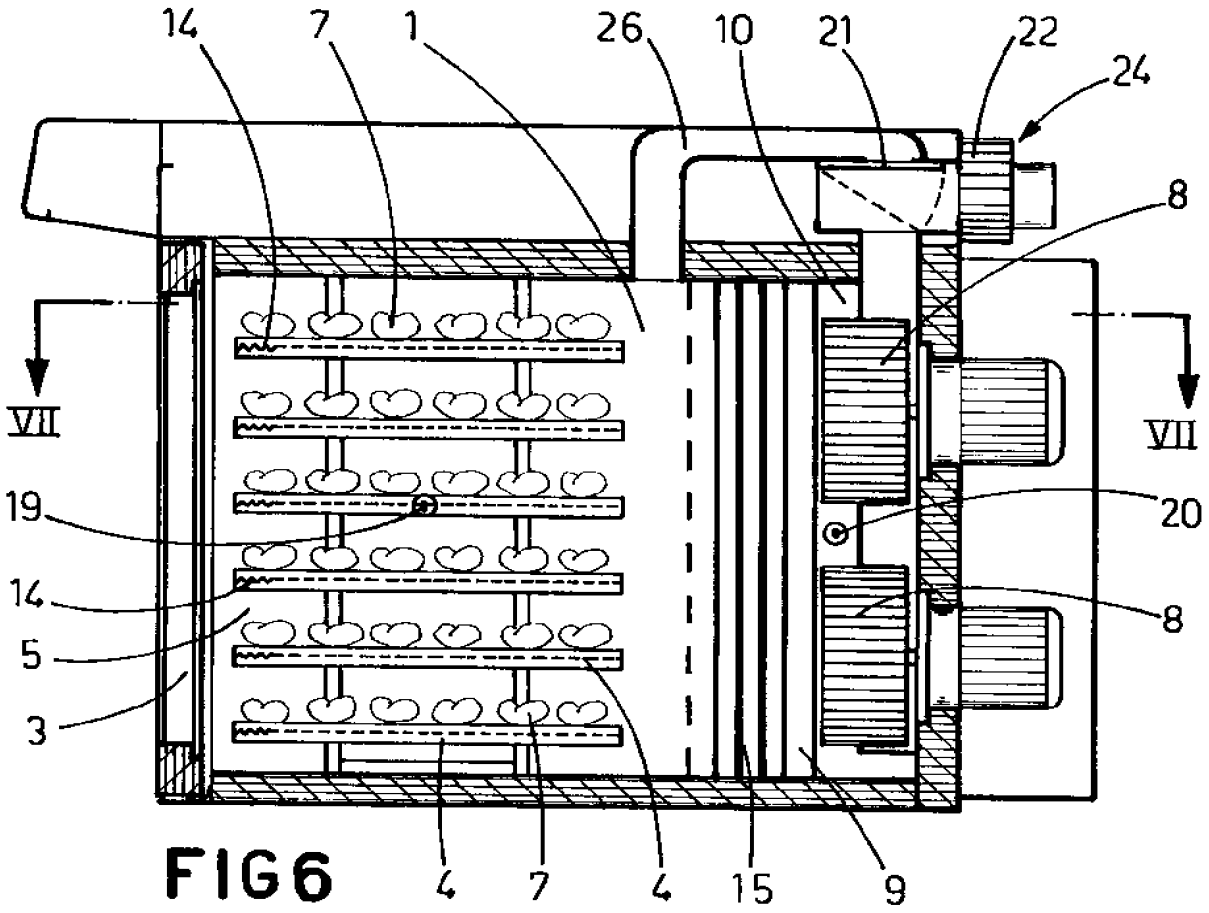


FIG3


14
7
1
26
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VII
VII
19
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15
9

FIG6

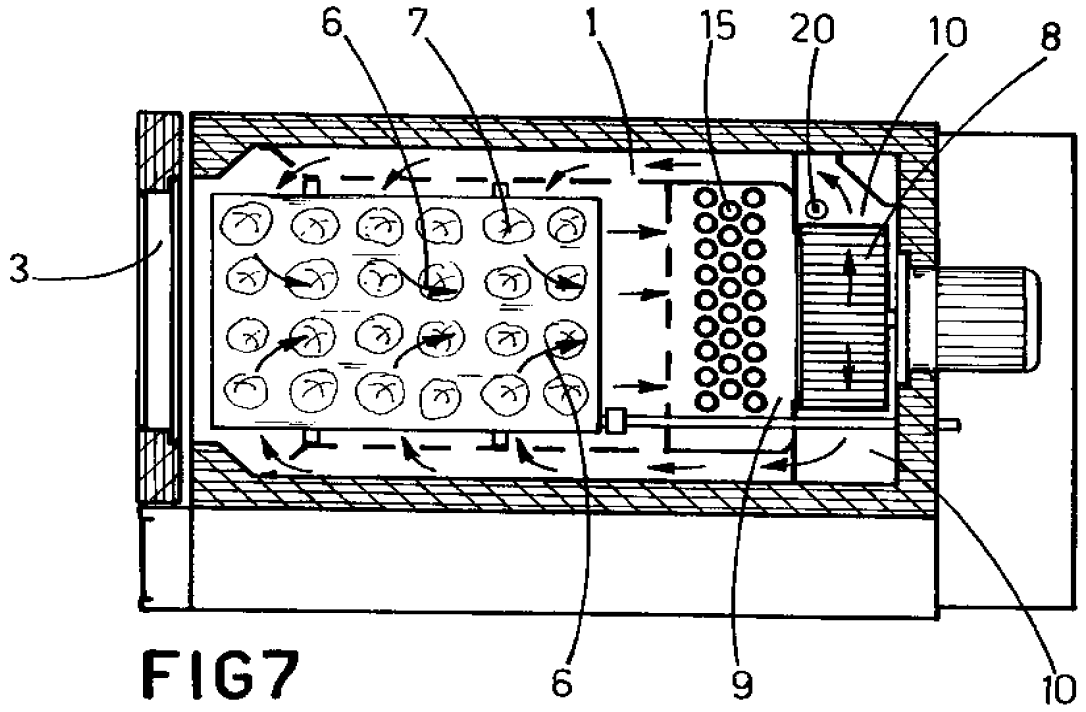
6
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FIG7

FIG8

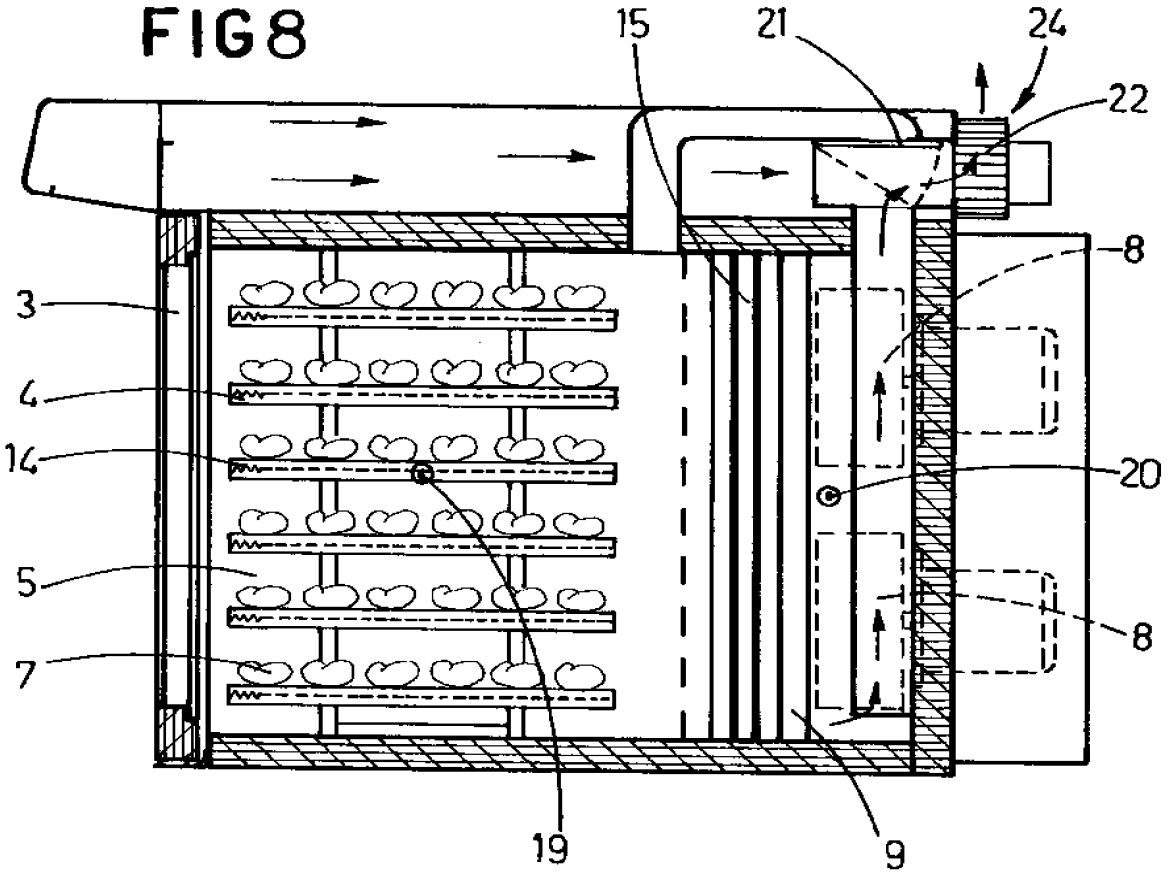
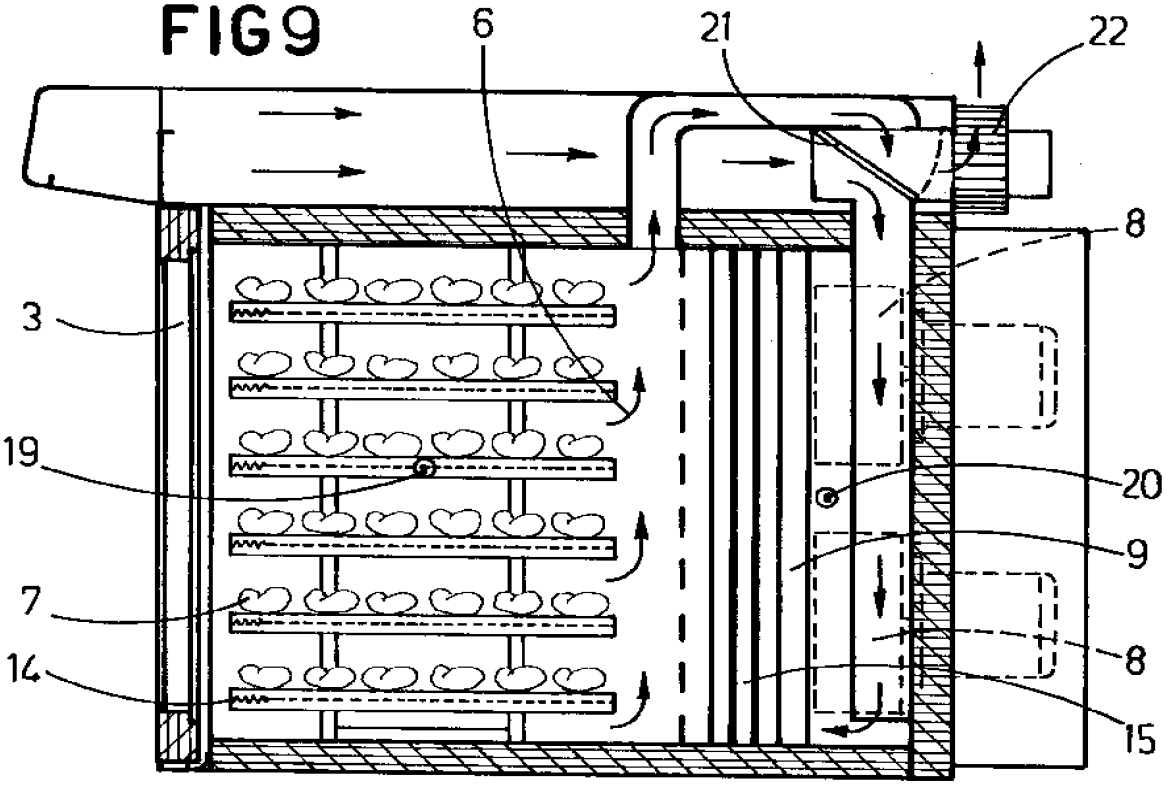


FIG9



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EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0270

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP-A-0 388 604 (WERNER & PFLEIDERER) * the whole document *	1-5	A21B1/40 F24C15/32 F24C7/08
Y	US-A-4 381 442 (GUIBERT) * column 7, line 39 - column 8, line 45; figures 2,13,14 *	1-5	
A	US-A-3 548 153 (KELLS)		
A	GB-A-1 429 482 (UNILEVER)		
A	FR-A-2 290 124 (DUPIC)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A21B
F24C
A47J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 November 1995	Vanheusden, J

CATEGORY OF CITED DOCUMENTS

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